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TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No. 01300033AA

In Re Application Of: **A. Okamoto**

Serial No.	Filing Date	Examiner	Group Art Unit
09/198,376	Nov. 24, 1998	A.J. Flanigan	3743

Invention: **Thermal Control Device**

TO THE ASSISTANT COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re patent application of

A. Okamoto

Serial No. 09/198,376 Group Art Unit: 3743

Filed: November 24, 1998 Examiner: Flanigan, Allen J.

For: THERMAL CONTROL DEVICE

Assistant Commissioner for Patents
Washington, D.C. 20231

APPELLANT'S BRIEF UNDER 37 C.F.R. §1.192

This brief, which is filed herewith in triplicate, is in furtherance of the Notice of Appeal, filed in this case on October 7, 2002.

This brief contains these items under the following headings, and in the order set forth below (37 C.F.R. §1.192(c)):

I. Real Party in Interest

The real party in interest in the appeal is: NEC Corporation, the assignee of this application.

II. Related Appeals and Interferences

With respect to other appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal: There are no such appeals or interferences.

III. Status of Claims

The status of the claims in this application are:

A. Total number of claims in Application: 6 total claims

Claims in the application are: all rejected

B. Status of all the claims:

1. Claims canceled: 2-3, 7-25, 28-30
2. Claims withdrawn from consideration but not canceled: None
3. Claims pending: 1, 4-6, 26, 27
4. Claims allowed: None
5. Claims rejected: 1, 4-6, 26-27 (all of the claims)

B. Claims on Appeal.

The claims on appeal are: Claims 1, 4-6, 26-27 (all of the claims)

IV. STATUS OF AMENDMENTS

The status of amendments filed subsequent to the final rejection are as follows: There was no after-final amendment. There is no un-entered amendment.

V. SUMMARY OF INVENTION

The present invention relates to heat control and more particularly to heat control feasible for, e.g., an artificial satellite or a spacecraft.

Spacecraft are expected to navigate a vacuum environment, with heat radiation from outside surfaces of the spacecraft being the only heat radiating means available. The amount of heat radiation dictates the temperature inside the spacecraft. Before the present invention, a thermal louver was used for maintaining adequate temperature inside the spacecraft. The conventional thermal louvers adjusted the amount of heat radiation to the outside in accordance with temperature, by the louver's use of a bimetal or similar actuator for driving blades. In conventional louvers, the blades were movable to increase or decrease the effective area and therefore the temperature of heat radiation surfaces, i.e., increase the amount of heat radiation at a high temperature or reduce it at a low temperature.[1] However, problematically, the conventional thermal louvers were mechanical in nature, including movable parts and therefore bulky and heavy, and also lacking in reliability due to the movable parts.[2]

The present invention uses a heat radiation characteristic particular to a substance itself, rather than a mechanical principle.[3] Thermal control devices and

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[1]Applicants' specification, page 1, lines 1-16.

[2]Id., lines 17-19. In addition, the blades of the conventional thermal louvers could not be opened and closed more than a certain limited number of times due to their limited life. Id., sentence bridging pages 1-2.

[3]Applicants' specification, page 3, lines 19-20.

methods according to the present invention can be used, e.g., to dictate the temperature inside a spacecraft operating in a vacuum environment.

The invention as defined in the claims on appeal is directed to a thermal control device[4] or a method of controlling a temperature of an object.[5] A particular Mn-containing perovskite is used, namely, $A_{1-x}B_xMnO_3$.[6] Such an Mn-containing perovskite has not been used in a thermal control device or a method of controlling a temperature of an object before the present invention. The recited features of the presently claimed substance are synonymous with the substance having positive temperature variance at temperatures around room temperature, which is a property found only extremely rarely in a few substances.

In the inventive thermal control device, the device comprises a substance comprising a perovskite Mn oxide mentioned above, wherein said substance exhibits certain emissivity characteristics.[7] The substance is affixed directly to an object, and the substance controls the temperature of the object.[8]

In the inventive method of controlling a temperature of an object, a variable-phase substance (exhibiting a property of an insulator or a property of a metal in a high temperature phase or a low temperature phase, respectively, and radiating a great amount of heat or a small amount of heat in a low temperature phase or the high

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[4]Independent Claim 1.

[5]Independent Claim 26.

[6]Independent Claims 1, 26. In the formula, A is at least one of La, Pr, Nd and Sm rare earth ions; B is at least one of Ca, Sr and Ba alkaline rare earth ions.

[7]The substance exhibits emissivity characteristics of an insulator at a relatively high temperature and emissivity characteristics of a metal at a relatively low temperature. The substance has a relatively low emissivity at the relatively low temperature and a relatively high emissivity at the relatively high temperature.

[8]Claim 1, last paragraph.

temperature phase, respectively) is affixed to the object to be temperature-controlled.[9] The substance is a perovskite Mn oxide of the formula mentioned above.

Examples of affixing the substance to the object are by powder coating, deposition, crystalline adhesion, etc.[10] The inventive thermal control device optionally may further include either a plate or a film mounted on the substance for transmitting infrared rays to the substance and reflecting visible rays away from the substance.[11] Examples of the object are an artificial satellite and a spacecraft.[12]

VI. ISSUES

A. WHETHER CLAIMS 1, 4, 26 AND 27 ARE UNPATENTABLE UNDER 35 U.S.C. 103(A) OVER GENSHIRO IN VIEW OF URUSHIBARA AND VAN BUSKIRK.

B. WHETHER CLAIMS 1 AND 4 ARE UNPATENTABLE UNDER 35 U.S.C. 103(A) OVER BENSON IN VIEW OF URUSHIBARA AND VAN BUSKIRK.

C. WHETHER CLAIMS 5 AND 6 ARE UNPATENTABLE UNDER 35 U.S.C. 103(A) OVER GENSHIRO IN VIEW OF URUSHIBARA AND BUSKIRK, AND FURTHER IN VIEW OF AMORE.

D. WHETHER CLAIMS 5 AND 6 ARE UNPATENTABLE UNDER 35 U.S.C. 103(A) OVER BENSON IN VIEW OF URUSHIBARA AND BUSKIRK, AND FURTHER IN VIEW OF AMORE.

VII. GROUPING OF CLAIMS

A. Claims reciting an artificial satellite or spacecraft (Claims 6 and 27).

B. Claims reciting a method of controlling temperature of an object (Claims

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[9]Claim 26.

[10]Claim 4.

[11]Claim 5.

[12]Claims 6, 27.

26-27)

C. Claims reciting a thermal control device (Claims 1, 4-6)

The claims of the above-mentioned groups do not stand or fall together. Reasons as to why the grouped claims are separately patentable are included in the arguments.

VIII. ARGUMENT: NO REJECTION UNDER 35 U.S.C. §103 IS MAINTAINABLE

A. <u>Claims 1,4 and 26-27 Should Not Stand Rejected as Obvious over a combination of Genshiro and two additional references</u>

Claims 1 and 26 are independent, and both require use of a particular recited perovskite Mn oxide material as a temperature controlling substance. Use of the claimed perovskite Mn oxide material as recited in the appealed claims makes possible room temperature practical applications (e.g., the room temperature environment within a spacecraft).

(1) The primary reference, Genshiro

The purpose of Genshiro (1989) was to obtain a lighter radiator which enables automatic temperature control by means of a structure member composed of only a radiating board by closely attaching the radiating board made of a superconducting material to the member to be heat-released. The Figures of Genshiro are structural, and the purpose of Genshiro is to disclose a desirable structure to construct. In such construction, Genshiro merely discloses general use of a superconducting material, and does not disclose or suggest elemental composition for the superconducting material. At the time of the presently claimed invention, certain superconductor materials were known for commercial or engineering use, and it would have been those superconductor materials that a person of ordinary skill in the art reading Genshiro would have used as the superconductor material to construct the Genshiro product.

Genshiro uses a superconductor that performs metal-insulator transition at

very low temperature. Thus, Genshiro is not applicable to an ordinary artificial satellite operating at temperatures needing to be around room temperature. Rather, a person of ordinary skill in the art would be thinking of Genshiro in connection with low-temperature commercial and practical applications, not in connection with room-temperature applications.

Additionally, the use of a superconductor material is central to Genshiro, and a person of ordinary skill in the art would not think to replace a superconductor material with a non-superconductor. Superconducting materials occupy a complex field, and when a commercial application calls for superconducting materials, it would be absurd and unworkmanlike for a person in the art to think to use a non-superconductor in place of the superconductor.

(2) Superconductors

Briefly reviewing the historical development of superconductors is useful for appreciating what a person of ordinary skill in the art in the mid-1990s (the time of the presently claimed invention) would think when a reference (such as Genshiro) generally disclosed use of a superconductor material.

In the early 1900s, helium was first liquified and identified as, at very low temperatures, losing all resistance – i.e., being a superconductor. Helium use was not very practical, and by about 1930, important new superconductors were identified, including Ta, Thorium, and Niobium. (A Nb-Ti alloy ultimately became today's most widespread commercial superconductor used in MRI systems and other applications.) In the 1950s, engineering superconductivity work began with Nb-Sn materials, followed by the more practical Nb-Zr and Nb-Ti alloy superconductors. The important feature to obtain was superconductivity at not-such-a-low temperature, and thus the search for alloys that were superconductors at relatively higher temperatures than the critical temperatures of then-known superconductors. It was not until 1986 that Muller and Bednorz made a ceramic perovskite of lanthanum, barium, copper, and oxygen that superconducted at 35K – for which they were awarded the Nobel

prize. Then, the next year, in 1987, Chu and Wu substituted yttrium for lanthanum and produced a ceramic that desirably superconducts at 92K. A year later, in 1988, Hermann and Sheng produced a superconductor at 120K, with Tl-Ca-Ba-Cu-O. In 1993, Schilling et al. produced a superconductor at 133K, in $HgBa_2Ca_2Cu_3O_8$. In 1995, Dai et al. provided a superconductor at 138K, for a nominal composition of $Hg_{0.8}T_{10.2}Ba_2Ca_2Cu_3O_{8+\delta}$.[13]

Common superconducting materials in industry use at the time of the presently claimed invention included Nb-Ti and Nb_3Sn,[14] with another commonly mentioned ceramic superconductor being $YBa_2Cu_3O_7$[15] (discovered about 1986) or a YBaCuO material.[16] One group of inventors referring to superconductors disclosed La–Ba–Cu, Y–Ba–Cu, Bi– and Tl– oxides.[17] Another group of inventors mentioned a superconductor that included bismuth, strontium, calcium, copper and oxygen.[18] In 1995, certain nickel-containing materials exhibiting superconductivity were patented by AT&T.[19]

None of U.S. patent nos. 5,479,144 (Martin Marietta), 5,479,059 (United Technologies Corp.), 5,478,801 (Hoechst Akt.), 5,061,686 (Hewlett-Packard), 5,478,398 (Sumitomo Electric), 5,470,530 (AT&T) mention Mn as a required or desirable element in a superconductor. These patents to diverse groups of inventors,

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[13]See "Superconductivity and Magnetism, A Historical Introduction to Superconductivity and Magnetism," http//www.cae.wisc.edu/~plee/superconductor-history.htm.

[14]See U.S. patent 5,479,144 (1995) (Martin Marietta).

[15]See U.S. patent 5,479,144 (1995) (Martin Marietta); U.S. patent 5,479,059 (1995) (United Technologies Corp.).

[16]See U.S. patent 5,061,686 (1991) (Hewlett-Packard).

[17]See U.S. patent 5,478,398 (1995) (Sumitomo Electric).

[18]See U.S. patent 5,478,801 (1995) (Hoechst Akt).

[19]See U.S. patent 5,470,530 (1995) (AT&T IPM Corp.).

at different companies, are strong evidence that a person of ordinary skill in the art at the time of the presently claimed invention, when mention of elemental composition of superconductors was made, would not have been thinking of an Mn-containing material as a superconductor. Nor had Mn-containing materials historically been identified as practically useful superconductors in the past.

Genshiro's device required use of a superconductor. A person of ordinary skill in the art reading Genshiro would have had no reason to replace Genshiro's required superconductor with a non-superconductor (whether the perovskite Mn oxide of Applicants' appealed claims or otherwise). With a non-superconductor, Genshiro's purpose could not be accomplished. Substitution of materials as proposed by the Examiner would not be performed by one of ordinary skill in the art to defeat the intended purpose of Genshiro.

(3) Urushibara et al., a secondary reference

The Urushibara et al. 1995 article cited as a secondary reference in the rejection is titled "Insulator-metal transition and giant magnetoresistance in $La_{1-x}Sr_xMnO_3$." Urushibara et al. do not characterize the material which is the subject of their study as a superconductor, even generally, and certainly not specifically for any particular application or use in a practical product. Urushibara et al. are not announcing or disclosing that a new material is a superconductor; they are not saying that any La-Sr-Mn oxide material loses all resistance when cooled below a certain critical temperature. Urushibara's Summary (at page 51) is that, using certain $La_{1-x}S_xMnO_3$ crystals,

"...we have investigated the transport and magnetic properties relating to the insulator-metal transition driven by carrier-doping and clarified the correlation between them. Large negative MR phenomena were observed near the critical temperature Tc for the ferromagnetic phase transition. Magnetic field-dependent as

well as temperature-dependent resistivity is well scaled with M. In the relatively low-M region ..., the negative MR value is well-described as [a certain expression] over the whole range of x. The x dependence of the coefficient C [in the mathematical expression] indicates that the hole-doping procedure drives the system towards the weak coupling regime. The mean-field-type theory for the ferromagnetic Kond-lattice model explains why the coefficient C (or the MR magnitude in the low-M region) can be so large ($C \sim 4$), yet effect of the quantum fluctuation of the local spins should be taken into account for the quantitative understanding of the MR phenomena in the high-M region as well as of the low-temperature transport properties."

Also, noticeably absent from Urushibara is any teaching whatsoever with respect to positive temperature variance or its potential use in heat control application. Urushibara is the only reference cited by the Examiner that relates to a Mn oxide perovskite. The materials discussed in Urushibara, like all materials, have many different properties that may be quantified, identified, characterized and the like. Importantly, Urushibara discusses other, different properties of certain perovskite materials – not the positive temperature variance properties that are exploited in the presently claimed invention. There is no evidence that anyone before Applicants appreciated the properties of an Mn oxide perovskite on which the presently claimed invention was made.

A person of ordinary skill in the art at the time of the presently claimed thermal control invention of Claims 1, 4 and 26-27 would not have been motivated to modify the Benshiro primary reference based on the Urushibara secondary reference. Rather, the person of ordinary skill in the art would have looked to then-disclosed, then-known superconductors, as disclosed in the large body of explicit superconductor literature. Substitution of the non-superconductor materials of Urushibara as proposed by the Examiner would defeat the intended purpose of Genshiro, and thus such as substitution cannot be imputed to a person in the art.

(4) Van Buskirk, another secondary reference

The Examiner acknowledges that with Genshiro and Urushibara, a person of ordinary skill in the art still would not arrive at the presently claimed invention of Claims 1, 4 and 26-27, and thus the Examiner further resorts to the Van Buskirk patent (1982), "Solar Selective Surfaces." Van Buskirk is concerned with:

"Postformable solar selective coatings are disclosed for use on substrates such as aluminum. The coatings use a finely divided black inherently selective spinel pigment such as Co_3O_4, $CuCr_2O_4$ or $Cu_xCo_{3-x}O_4$ where x is 0.03 to 0.3 and preferably 0.10 to 0.30. The binders are soluble copolymers of vinylidene fluoride or blends thereof or vinylidene fluoride with a copolymer of methyl methacrylate."

(Abstract.) Van Buskirk's sole figure is of absorbance versus wavelength, to show the effect of copper doping on absorbance spectra of certain Cu-Co oxide pigments. Van Buskirk was concerned with making a coating paintable onto a surface, for achieving solar heat collection, working in a existing field of flat-plate solar collectors. (Van Buskirk, col. 1, lines 11+) Absorbance of solar radiation was thus the focus. Van Buskirk was concerned with solar absorptance and infrared emittance (e.g., Tables I, VII), and radiation properties (e.g., Table III). Van Buskirk does not disclose or relate to Mn-containing materials.

(5) Assumptions underlying the obviousness rejection

The Examiner assumes that a person of ordinary skill in the art would have been motivated to modify Genshiro by Van Buskirk and Urushibara. This assumption is not how a person of ordinary skill in the art would have thought. A person of ordinary skill in the art would be unmotivated by either Van Buskirk or Urushibara to modify Genshiro. Genshiro discloses, generally, use a heat control device that includes a superconductor material. Certain superconductor materials were known.

The material recited in Applicant's claimed invention was not disclosed as a superconductor material, and thus a person of ordinary skill in the art would not have been thinking of it as a superconductor material useable in Genshiro's device. Discovering new superconductor materials was work at a level that was winning a Nobel prize–not a casual assumption or chain of assumptions imputable to a person of ordinary skill in the art. A person of ordinary skill in the art reading Genshiro would construct a heat control device using a known superconductor.

As for Van Buskirk, that patent does not disclose or relate to superconductor materials. A person of ordinary skill in the art would read Genshiro (providing for use of a "superconductor material" in constructing a device) and Van Buskirk (concerning something other than superconductors) separately. It is only having Applicants' patent specification in hand, that makes the Examiner want to try to resort to Van Buskirk to supply deficiencies in Genshiro. The assumptions on which the obviousness rejection is based, therefore, are not in accord with the thinking of a person of ordinary skill in the art, and thus cannot be invoked to support the rejection.

For all of the reasons set forth above, Appellant respectfully requests reversal of the obviousness rejection of Claims 1, 4 and 26-27 based on Genshiro in view of Urushibara and Van Buskirk.

B. Claims 1 and 4 Should Not Stand Rejected Over Benson and The Two Secondary References Mentioned Above (Urushibara and Van Buskirk)

(1) Benson

Benson (1996) is directed to "Material-controlled Dynamic Vacuum Insulation." Benson is using a multi-layered, chambered insulating panel. Benson essentially uses "two metal sidewalls separated by a vacuum chamber and held apart by glass-like spacers and sealed around the edges with metal-to-metal welds and one or more disabling features capable of frustrating the ability of the vacuum chamber to

inhibit the flow of heat from one sidewall to the other."[20]

Benson identifies seven important features that are combined in his invention: "...the important combination of features to obtain effective compact vacuum insulation according to this invention include: (1) the thin and hard but bendable metal wall sheets **12, 14** closely spaced together; (2) glass or glass-like spacers **16** or **64** that not only have low thermal conductivity, but also do not evolve gases, like plastics and other materials would; (3) the glass or glass-like spacers ... are discrete objects in spaced apart relation, not powders or fibers that would trap gases, provide more thermal conductivity, and interfere with the leak-proof integrity of welded seals; (4) the spacers ... are rounded or pointed to provided "point" or "near point" contact, not flat surface contact, with the wall sheets...; (5) the vacuum in the space or chamber **15** is sufficient to meet the criteria of having the mean free path between molecular collisions greater than the distance between wall sheets **12, 14**, preferably lower than 10^{-5} torr...; (6) the edge seals **18** are metal-to-metal welds that can seal the vacuum for twenty years or longer, not plastics, glass, adhesives, or clamp strips that leak or evolve gases enough to disable the insulative effect in a short timeor need intermittent re-evacuation; and (7) low emissivity surfaces or surface coatings **17, 19** on the sidewalls **12, 14.** "
(Benson, col. 5, lines 11-34.)

In that context, Benson uses a variable emissivity coating 170 on the interior surface of sidewall 12. (Benson, col. 7, lines 26-27.) Benson's "variable emissivity coating 170 varies heat transfer by varying infrared radiation". (Benson, col. 7, lines 29-31.) Materials that Benson discloses for the variable emissivity coating 170 are

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[20]Benson, sentence bridging cols. 2-3. "Disablement by thermal short circuit via metal-to-metal contacts are implemented by bimetallic laminated, bimetallic nonlaminated, anchored monometal, or plastic memory metal switches that bridge the chamber in response to change of temperature or that push the sidewalls together against separation bias." Benson, col. 3, lines 4-9.

vanadium oxide, nickel hydroxide, tungsten trioxide; titanium oxide, nickel sulfide, and vanadium oxy fluoride. (Benson, col. 7, lines 57-66; col. 13, lines 58-65.)

The perovskite Mn oxide of Applicants' appealed Claims 1 and 4 is <u>not</u> disclosed in Benson.

(2) Urushibara and van Buskirk, Secondary References

The same secondary references (Urushibara and van Buskirk) are cited in this rejection as for the obviousness rejection discussed above.

A person of ordinary skill in the art would not be motivated to combine Urushibara with Benson, or to modify Benson based on Urushibara. A person of ordinary skill in the art would treat Urushibara as separate from Benson. Urushibara does not state or imply that his Mn oxide perovskite has any relation to the materials of Benson which are neither Mn oxides nor perovskites.

Van Buskirk also is separate and distinct from Benson, and a person of ordinary skill in the art would see separateness – not any sort of combinability -- between the teachings of the references. Objectively viewed, to a person of ordinary skill in the art without the benefit of the present Applicants' specification, absolutely no link exists between Benson and Van Buskirk. Nothing about Van Buskirk can fairly be said to lead a person of ordinary skill in the art away from the materials recited in Benson, and towards a material to which neither Benson nor Van Buskirk related.

For the reasons set forth above, Appellant respectfully submits that the obviousness rejection of Claims 1 and 4 over Benson in view of Urushibara and Van Buskirk should be reversed.

C. <u>Claims 5-6 Should Not Stand Rejected Under 35 U.S.C. 103(a) over Genshiro in view of Urushibara and van Buskirk, further in view of Amore</u>

Claim 5 depends on claims 4 and 1, and provides that either a plate or a film is mounted on the temperature-controlling substance. (Claim 5.) The mounted plate or

film transmits infrared rays to the substance and reflects visible rays away from the substance. (Claim 5.) Claim 6 depends on claim 5, and provides that the object (to which the temperature-controlling substance is attached) is an artificial satellite or a spacecraft.

The Amore patent, for a "Heat Rejecting Spacecraft Array Antenna," still does not supply the deficiencies in Genshiro, the primary reference. Amore does not disclose or suggest the certain Mn perovskite oxide of Applicants' base claim 1, nor the use of such an Mn perovskite oxide as a temperature controlling substance attached to an object to be temperature-controlled. The reasons set forth in Section A, above, apply equally with regard to this obviousness rejection based on four references, not one of which shows using an Mn perovskite oxide as a temperature controlling substance attached to an object having its temperature controlled.

With regard to claim 6, the obviousness rejection is particularly without merit. Not one of the four relied-upon references shows use of the claimed Mn perovskite oxide in connection with a satellite or spacecraft. Any cited reference that discloses satellite or spacecraft technology is completely silent as to an Mn perovskite. There is no evidence that Mn perovskite materials were in any sort of use in satellite or spacecraft technology, much less the specific claimed use in a thermal control device according to the appealed claims.

For the reasons set forth above, Appellant respectfully submits that the obviousness rejection of Claims 5-6 over Genshiro in view of Urushibara, Van Buskirk and Amore should be reversed.

D. <u>Claims 5-6 Should Not Stand Rejected Under 35 U.S.C. 103(a) over Benson in view of Urushibara and van Buskirk, further in view of Amore</u>

Amore does not supply the deficiencies of Benson, the primary reference. As noted above, Amore does not disclose or suggest the certain Mn perovskite oxide of Applicants' base claim 1, nor the use of such an Mn perovskite oxide as a temperature

controlling substance attached to an object having its temperature controlled.

Moreover, with particular regard to claim 6, the obviousness rejection is further without merit, in that not one of the four relied-upon references shows use of the claimed Mn perovskite oxide in connection with a satellite or spacecraft even generally, much less specifically for temperature-controlling.

In view of the above, Appellant respectfully submits that the rejection of Claims 5-6 as obvious over Benson in view of Urushibara, van Buskirk and Amore should be reversed.

IX. Appendix of Claims Involved in the Appeal (37 C.F.R. §1.192(c)(9))

The text of the claims involved in the appeal are:

1. A thermal control device comprising:

a substance comprising a perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$, where A is at least one of La, Pr, Nd and Sm rare earth ions, and B is at least one of Ca, Sr and Ba alkaline rare earth ions, wherein said substance exhibits emissivity characteristics of an insulator at a relatively high temperature and emissivity characteristics of a metal at a relatively low temperature, said substance having a relatively low emissivity at the relatively low temperature and a relatively high emissivity at the relatively high temperature; and

an object having said substance affixed directly thereto, wherein said substance controls the temperature of said object.

4. A thermal control device as claimed in claim 1, wherein said substance is affixed to the object by powder coating, deposition, crystalline adhesion or adhesion of a film formed of a substance containing a binder.

5. A thermal control device as claimed in claim 4, further comprising either one of a plate and a film mounted on said substance for transmitting infrared rays to said substance and reflecting visible rays away from said substance.

6. A thermal control device as claimed in claim 5, wherein the object comprises either one of an artificial satellite and spacecraft.

26. In a method of controlling a temperature of an object, a variable-phase substance exhibiting a property of an insulator or a property of a metal in a high temperature phase or a low temperature phase, respectively, and radiating a great amount of heat or a small amount of heat in a low temperature phase or the high

temperature phase, respectively, is affixed to said object wherein a transition temperature of said substance depends upon a value of x in the perovskite Mn oxide of Mn-containing perovskite represented by $A_{1-x}B_xMnO_3$ causes a transition temperature, where A is at least one of La, Pr, Nd and Sm rare earth ions, and B is at least one of Ca, Sr, and Ba alkaline rare earth ions.

27. A method as claimed in claim 26, wherein the object comprises either one of an artificial satellite and spacecraft.

X. Other Materials that Appellant Considers Necessary or Desirable

An English-language translation of the Japanese language Genshiro kokai will be submitted to the Board of Appeals and Patent Interferences when it becomes available to the undersigned.

Respectfully submitted,

Michael E. Whitham
Reg. No. 32,635

Whitham, Curtis & Christofferson, P.C.
11491 Sunset Hills Road, Suite 340
Reston, VA 20190
Tel. (703) 787-9400 or (703) 391-2510
Fax. (703) 787-7557 or (703) 391-9035
Customer No. 30743

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